

REMARKS

After entry of the present amendments, Claims 1-13 and 38-39 will be pending in this application. Applicant submits that new Claims 38 and 39 read on the elected species.

Claim 1 is amended herein to recite that A is Cu, B is In, and C is Ga. Claim 1 is also amended to clarify that the absolute shift in the $2\theta_{(112)}$ angle is less than 0.06° between any one of the glancing angles measured at 0.5° , 1° , 2° , 5° , and 10° and any other one of them considered one at a time. Thus, the differences between the values for the $2\theta_{(112)}$ angle measured at any of the listed angles (0.5° , 1° , 2° , 5° , and 10°) is within 0.06° of the values measured for any of the other listed angles. Claims 4, 7, 14, and 18 are adjusted in view of the amendments to Claim 1. Support for the amendments can be found throughout the specification and claims as originally filed, for example at page 9, lines 23-25; page 11, lines 9-11; page 37, line 28 to page 38 line 7; and page 42, lines 1-15 (corresponding to paragraphs [0042], [0054], and [0195] and Tables 3 and 4). No new matter is added.

Applicant wishes to thank the Examiner and the Examiner's supervisor for taking the time to conduct an in-person interview with the Applicant and the Applicant's representative on February 2, 2010.

Claims 1-13 stand rejected under 35 U.S.C. § 103 as unpatentable over Ohashi ("Improved CIGS thin-film solar cells by surface sulfurization using In_2S_3 and sulfur vapor").

Claim 1 is amended herein to recite "a glancing incidence x ray diffraction pattern (GIXRD) for glancing angles at 0.5° , 1° , 2° , 5° , and 10° reflects an absolute shift in the $2\theta_{(112)}$ angle of less than 0.06° between any one of such glancing angles and all of the other of such angles considered one at a time." Applicant submits that Ohashi fails to disclose such an alloy.

First, Ohashi fails to disclose a full range of GIXRD data and excludes angles of 0.5° , 2° , and 5° . For the material of Ohashi, the skilled artisan would expect shifts of greater than 0.06° between any two of the glancing incident angles of 0.5° , 2° , and 5° . Declaration of Dr. Vivian Alberts ¶ 6-8.

Second, this is further supported by Figure 3(b) of "A comparison of the material and device properties of homogeneous and compositional graded $\text{Cu}(\text{In,Ga})(\text{Se,S})_2$ chalcopyrite thin films", which was published by the Applicant in 2007 in Semiconductor Science and Technology, 22, 585. Figure 3(b) shows a significant shift between two of the five angles

measured (0.2°, 0.5°, 1.0°, 5.0°, and 10°) for the compositionally graded CIGSSe sample. The graded CIGSSe sample measured in the article would be expected to possess similar properties to the alloys produced and studied in Ohashi. Declaration of Dr. Vivian Alberts ¶ 7.

Third, the alloys of Ohashi are clearly heterogeneous with compositional gradients in the alloys. The AES depth profiling of Ohashi clearly shows the grading of gallium towards the back contact and the increased sulfur content due to the surface sulfurization. Thus, the compositional gradients would result in a shift in the $2\theta_{(112)}$ angle peak between at least one pair of the recited angles. Declaration of Dr. Vivian Alberts ¶ 6.

Further, the skilled artisan would expect alloys produced by the two-stage method or co-evaporation processes of the prior art methods used in Ohashi to exhibit shifts of greater than 0.06° between at least one pair of the glancing incident angles of 0.5°, 2°, and 5°. Declaration of Dr. Vivian Alberts ¶ 6-8.

For the reasons discussed above, Ohashi fails to disclose or make obvious the features of Claim 1 as amended herein.

No reasonable expectation of success

Moreover, one skilled in the art would have no reasonable expectation of success for forming an alloy with the recited properties. *Pharmastem Therapeutics v. Viacell, Inc.* 491 F.3d 1342, 83 U.S.P.Q.2d 1289 (Fed. Cir. 2007) (after *KSR*, Federal Circuit finds claims non-obvious for lack of indication of reasonable expectation of success for asserted combination). Ohashi fails to disclose how to overcome the problems known in the art with the two-stage process and co-evaporation process. The alloy formed in Ohashi is heterogeneous and would not be expected to produce the recited GIXRD pattern because of the heterogeneous composition and presence of multiple phases. Thus, there is no reason to deposit a film with the claimed features and no expectation of success to deposit a film with the claimed features by the methods disclosed in Ohashi. Again, there is no teaching or suggestion in Ohashi for how to overcome the problems known in the art with the two-stage or co-evaporation methods to achieve a film with the recited properties.

Dependent Claims

The Examiner further found the features of Claims 6-13 to be inherent, relying on cases in which the claimed and prior art products were identical or substantially identical in structure or composition, or were produced by identical or substantially identical processes. As discussed above, in the present application the products are not produced by the same methods and the products are clearly different. Accordingly, Applicant submits that the caselaw is not applicable to the current facts and that the Examiner has not met his burden to show that the features of even Claim 1 must necessarily flow from the cited references, as required. The cited references also fail to disclose the features of the dependant claims.

In particular, Ohashi fails to disclose or make obvious any of the recited variance in d-spacing values. Applicant notes that Ohashi fails to disclose any d-spacing values, much less “wherein the alloy has a crystal structure comprising a lattice of unit cells, wherein all crystallographic planes of the unit cells show a variance in d-spacing of less than 0.01Å” or “wherein the alloy has a crystal structure comprising a lattice of unit cells, wherein all crystallographic planes of the unit cells show a variance in d-spacing of less than 0.001Å” as recited in Claims 2 and 8, respectively. Also, these features are not inherent as the Examiner has provided no basis for a finding that the features are necessarily present in the cited art and because the films are produced by different methods and would therefore necessarily be different. There is no teaching of how to modify the art to achieve the recited features or any expectation of success. Accordingly, Applicant request that the rejections of Claims 2 and 8 be withdrawn for at least this reason.

Ohashi also fails to teach the features of Claim 3. Claim 3 recites in part “wherein the element concentration of elements A, B, C, D, and E, as characterized by XPS depth profiling, is substantially uniform through the alloy”. The Examiner found that substantially uniform XPS depth profiling was inherent in the cited reference. Applicants respectfully disagree because, as discussed above, Ohashi clearly discloses compositional gradients throughout the entire film. This is shown in the AES profiles for the alloys in Figs. 1(a) and 3(b). Therefore Ohashi fail to disclose this feature. Accordingly, Applicant request that the rejections of Claim 3 be withdrawn for at least this reason.

Ohashi also fails to disclose the features of Claims 11 and 12. Claim 11 recites in part “wherein the alloy has a band gap that can be shifted from 1 eV to 2.4 eV” and Claim 12 recites in part “wherein the alloy has a band gap that can be shifted from 1.1 eV to 1.5 eV.” In the heterogeneous alloys of Ohashi, the band gap energy of the bulk material does not shift with a variation in the ratio of the group VI element. In the case of the Ohashi alloys, the band gap is only moderately modified in the near-surface region of the alloy due to the “surface sulfurization” process. Declaration of Vivian Alberts ¶ 7-8. This is supported by the Voc values in Fig 2(b) which are directly related to the band gap of the resulting alloy. Thus, Ohashi also fails to disclose the features of Claims 11 and 12. Accordingly, Applicant respectfully requests withdrawal of the rejection of Claims 11 and 12 for at least this reason.

Additionally, Applicant submits that Claims 4-7, 9-10, and 13 also define over the cited references, not only because they depend from Claim 1 but also on their own merit.

New Claims

As discussed above, Ohashi fails to disclose an alloy where glancing angles at 0.5°, 1°, 2°, 5°, and 10° reflect an absolute shift in the $2\theta_{(112)}$ angle of less than 0.01°. Applicant submits that new Claims 38 and 39 are also not made obvious or anticipated by Ohashi.

Request for rejoinder

Applicant submits that the claims are in condition for allowance. Claim 1 is currently generic. Upon allowance of a generic claim, Applicant respectfully requests rejoinder of withdrawn Claims 14-37.

No Disclaimers or Disavowals

Although the present communication includes alterations to the application or claims, or characterizations of claim scope or referenced art, Applicant is not conceding in this application that previously pending claims are not patentable over the cited references. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure,

Application No.: 10/568,229
Filing Date: February 14, 2006

including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

Co-Pending Applications of Assignee

Applicant wishes to draw the Examiner's attention to the following co-pending applications of the present application's assignee.

Docket No.	Serial No.	Title	Filed
DMKISCH.002APC	10/568,227	Method for the Preparation of Group IB-IIA-VIA Quaternary or Higher Alloy Semiconductor Films	May 17, 2006

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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Dated: February 17, 2010

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